

OUTLINE

The RP901K is CMOS based PWM step-down DC/DC converter combined with a 600mA LDO and a voltage detector (VD), with low supply current.

Because of DFN(PLP)2527-10 package, high density mounting on boards is possible.

Step-down DC/DC converter

This portion consists of an oscillator, a switching control circuit, a reference voltage unit, an error amplifier, a soft-start circuit, current protection circuits, UVLO circuit, switching transistors and so on.

Because of synchronous rectifier type, a low ripple and high efficiency DC/DC converter can be easily composed of this IC with an inductor and capacitors only.

Mode alternative circuit works automatically for improving the efficiency at light load.

As protection circuits, the current limit circuit which limits peak current of Lx at each clock cycle, and latch type protection circuit which works if term of the over-current keeps on a certain time exists. The latch-type protection circuit works to latch an internal driver with keeping it disable. (LDO and VD keep working.)

In order to release the condition of the protection, after disabling this IC with a chip enable circuit, enable it again, or restart this IC with power-on or make the supply voltage at UVLO detector threshold level or lower.

The output voltage is internally fixed with +/-2% tolerance.

LDO

This portion consists of a reference voltage unit, an error amplifier, a short current protection circuit and so on.

The output voltage is internally fixed with +/-1% tolerance

VD

The input voltage is monitored by VD with Nch open drain output.

Power-on reset delay time is also included and internally set typically at 50ms.

FEATURES

- Input Voltage range : 4.5V to 5.5V
- Supply Current : 460μA
- Supply Current at light load : 170μA
- Package : DFN(PLP)2527-10
- External Components : $C_{IN}=10\mu F$
: $C_{OUT}=10\mu F$, $L=4.7\mu H$ (DC/DC)
: $C_{OUT}=2.2\mu F$ (LDO)

Step-down DCDC converter

- Output Voltage range : 1.2V to 1.8V
- Accuracy Output Voltage : +/-2%
- Oscillator Frequency : 1.2MHz
- Built-in Driver ON Resistance : 0.25ohm(Pch/Nch at $V_{IN}=5V$)
- Soft Start time : 1ms
- Lx peak current : 1.4A
- Output Current : 800mA
- Built-in Latch type Protection : 0.1ms
- Built-in UVLO Function : 3.5V

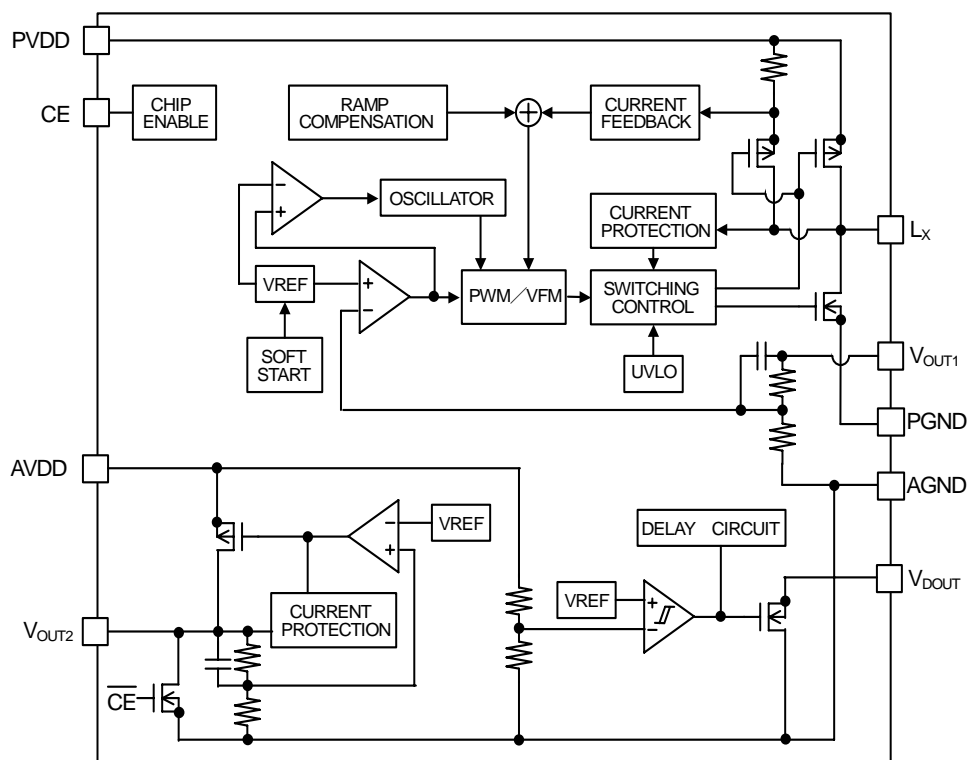
LDO

- Output Voltage range : 2.5V to 3.3V
- Accuracy Output Voltage : +/-1%

VD

- Voltage Detector Threshold Voltage range : 3.0V to 5.0V
- Power-on reset delay time : 50ms

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

(GND=0V)

Item	Symbol	Rating	Unit
PVDD Supply Voltage	V _{IN1}	6.0	V
AVDD Supply Voltage	V _{IN2}	6.0	V
CE Pin Input Voltage	V _{CE}	-0.3 to 6.0	V
Lx Pin Voltage	V _{LX}	-0.3 to V _{IN1} +0.3	V
Lx Pin Output Current	I _{LX}	1.4	A
V _{OUT1} Pin Voltage	V _{OUT1}	-0.3 to V _{IN1} +0.3	V
V _{OUT2} Pin Voltage	V _{OUT2}	-0.3 to V _{IN2} +0.3	V
V _{OUT2} Pin Output Current	I _{OUT2}	700	mA
V _{DOUT} Pin Voltage	V _{DOUT}	-0.3 to 6.0	V
Power Dissipation ^{*1}	P _D	1750(T _{jmax} =150°C)	mW
Operating Temperature Range	T _{OPT}	-40 to 85	°C
Storage Temperature Range	T _{STG}	-55 to 125	°C

* For Power Dissipation, please refer to next page to be described.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum ratings are threshold limit values that must not be exceeded ever for an instant under any conditions. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

POWER DISSIPATION (DFN(PLP)2527-10)

This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

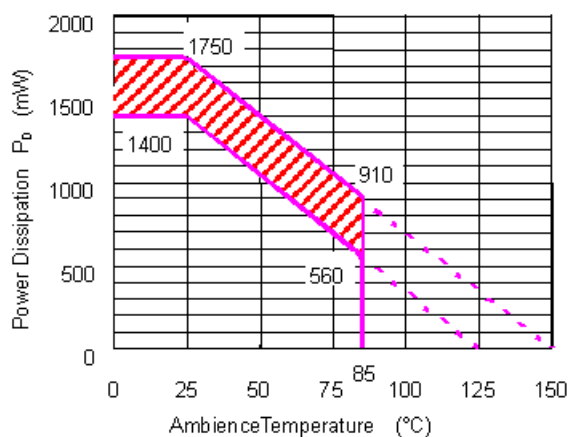
Measurement Conditions

	Standard Test Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (4-Layers)
Board Dimensions	35mm * 90mm * 0.8mm
Copper Ratio	Each layers: Approx. 15%
Through-holes	ϕ 0.30mm * 9pcs ϕ 0.50mm * 10pcs

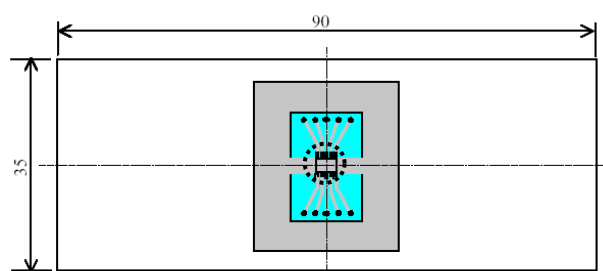
Measurement Result

($T_{opt}=25^{\circ}\text{C}$)

	Standard Test Land Pattern
Power Dissipation	1400mW($T_{jmax}=125^{\circ}\text{C}$) 1750mW($T_{jmax}=150^{\circ}\text{C}$)
Thermal Resistance	$\theta_{ja} = (125-25^{\circ}\text{C})/1.4\text{W} = 71^{\circ}\text{C/W}$



Power Dissipation



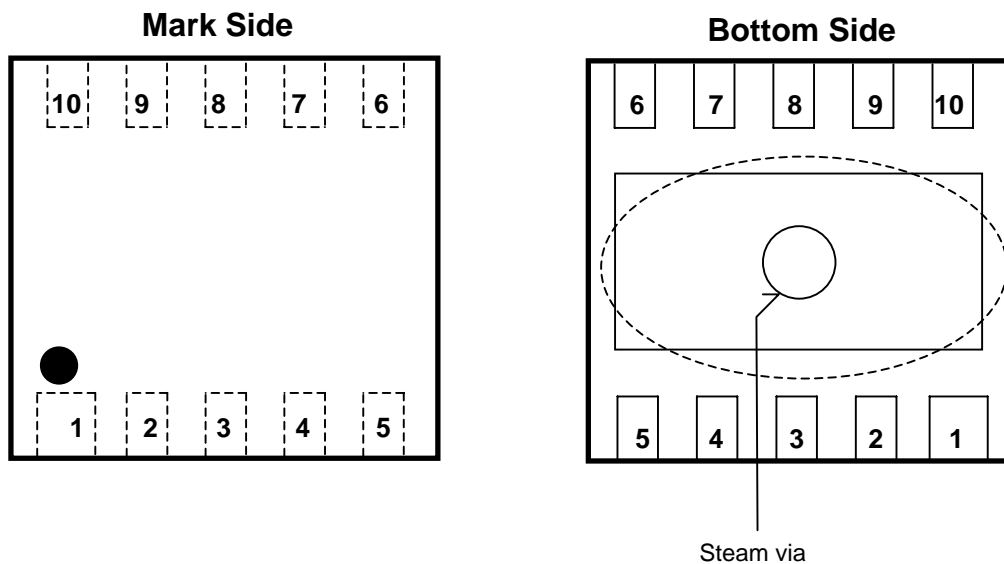
○ IC Mount Area (Unit:mm)

Measurent Board Pattern

-Use in the oblique-line-area might be influence the product-life cycle, please suppress by 13,000 hours about use. 13,000 hours will correspond in nine years when using it for four hours a day.

PACKAGE

DFN(PLP)2527-10



PIN DESCRIPTION

Pin No.	Pin Name	Pin Description
1	CE	Chip Enable ("H" active)
2	V _{DOUT}	Output (VD : Nch open drain)
3	AGND	Ground (analog)
4	PGND	Ground (power)
5	L _X	Lx Switching (DC/DC)
6	PVDD	Voltage Supply (power)
7	NC	No connect
8	V _{OUT1}	Output (DC/DC)
9	AVDD	Voltage Supply (analog)
10	V _{OUT2}	Output (LDO)

*PVDD and AVDD must be on the same voltage level

ELECTRICAL CHARACTERISTICS

(T_{opt}=25°C)

Symbol	Item	Condition	MIN.	TYP.	MAX.	Unit
V _{IN1} , V _{IN2}	Operating Input Voltage		4.5		5.5	V
I _{SS1}	Supply Current1	V _{IN1} =V _{CE} =5.5V, V _{OUT1} =V _{SET} * 0.8		460		μA
I _{SS2}	Supply Current2	V _{IN1} =V _{CE} =5.5V, V _{OUT1} =V _{SET} * 1.2		170		μA
I _{STB}	Stand-by Current	V _{IN1} =5.5V, V _{CE} =0V		2.0	10	μA
V _{CEH}	CE "H" Input Voltage		1.0			V
V _{CEL}	CE "L" Input Voltage				0.4	V

DC/DC part

(T_{opt}=25°C)

Symbol	Item	Condition	MIN.	TYP.	MAX.	Unit
V _{OUT1}	Output Voltage	V _{IN1} =5V	-2.0%		+2.0%	V
ΔV _{OUT1} /ΔT	Output Voltage Temperature Coefficient	-40°C ≤ T _{OPT} ≤ 85°C		±150		ppm /°C
F _{OSC}	Oscillator Frequency	V _{IN1} =5V	-20%	1.2	+20%	MHz
I _{LXLEAKH}	L _X "H" Leakage Current	V _{IN1} =V _{LX} =5.5V, V _{CE} =0V	-1	0	5	μA
I _{LXLEAKL}	L _X "L" Leakage Current	V _{IN1} =5.5V, V _{CE} =V _{LX} =0V	-5	0	1	μA
R _{ONP}	ON Resistance of Pch Tr.	V _{IN1} =5V, I _{LX} = -100mA		0.25		ohm
R _{ONN}	ON Resistance of Nch Tr.	V _{IN1} =5V, I _{LX} = -100mA		0.25		ohm
Maxdty	Maximum Duty Ratio		100			%
T _{START}	Soft Start Time	V _{IN1} =V _{CE} =5V		1.0		ms
I _{LXLIM}	L _X Current Limit	V _{IN1} =V _{CE} =5V	1.0	1.4		A
T _{PROT}	Protection Delay Time	V _{IN1} =V _{CE} =5V		0.1		ms
V _{UVLO1}	UVLO Detecting Voltage	V _{IN1} =V _{CE}	3.40	3.50	3.60	V
V _{UVLO2}	UVLO Released Voltage	V _{IN1} =V _{CE}	3.63	3.73	3.83	V

*) Test circuit is "OPEN LOOP".

V_{IN1}=V_{IN2}=V_{CE}=5V, AGND=PGND=0V unless otherwise noted.

LDO part(T_{opt}=25°C)

Symbol	Item	Condition	MIN.	TYP.	MAX.	Unit
V _{OUT2}	Output Voltage	V _{IN2} =5V	-1.0%		+1.0%	V
I _{OUT2}	Output Current		600			mA
I _{SS3}	Supply Current	V _{IN2} =V _{CE} =5.5V		60		μA
ΔV _{OUT2} /ΔI _{OUT2}	Load Regulation	1mA ≤ I _{OUT2} ≤ 400mA		40	80	mV
ΔV _{OUT2} /ΔT	Output Voltage Temperature Coefficient	-40°C ≤ T _{OPT} ≤ 85°C		+/-50		ppm /°C
I _{LIM}	Short Current Limit	V _{OUT2} =0V		70		mA
T _{VR}	Power-ON sequence time	After soft-start function of DC/DC was ended		2.0		ms
R _{LOW}	ON Resistance of Auto-Discharge Nch Tr.	V _{IN2} =5V V _{CE} =0V		50		ohm

VD part(T_{opt}=25°C)

Symbol	Item	Condition	MIN.	TYP.	MAX.	Unit
-V _{DET}	VD Detector Threshold		-2.0%		+2.0%	V
Δ-V _{DET} /ΔT	VD Detector Threshold Temperature Coefficient	-40°C ≤ T _{OPT} ≤ 85°C		+/-100		ppm /°C
V _{HYS}	Hysteresis Range			-V _{DET} x 0.05		V
T _{PLH}	Power-on Reset Delay Time			50		ms
I _{DOU TL}	V _{DOU T} "L" Output Current	V _{IN} =2.0V, V _{DOU T} =0.1V	1.0	4.0		mA